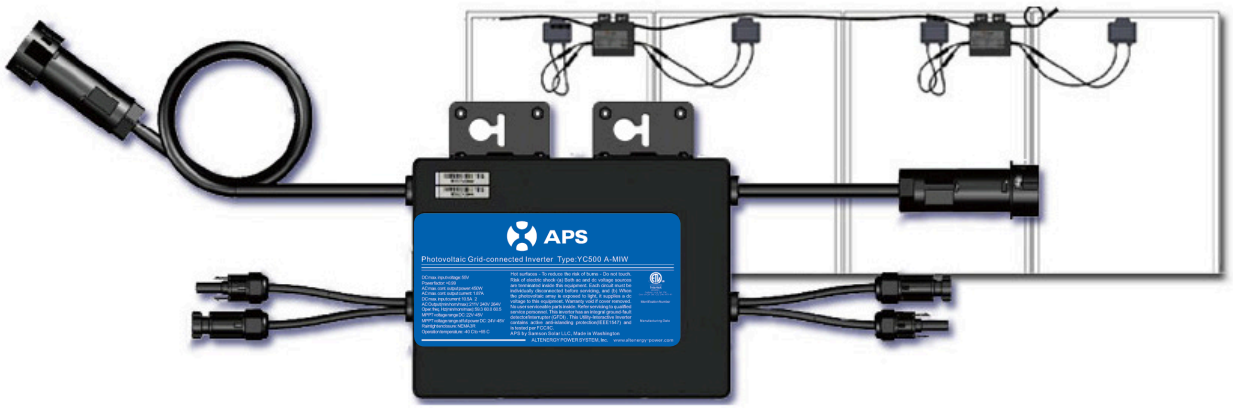

Installation/User Manual

APS YC500A-MIW
Photovoltaic Grid-connected Inverter

Version 4.1 2/2015

bluefrogsolar

APS MICROINVERTER

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TABLE OF CONTENTS

IMPORTANT SAFETY INSTRUCTIONS 1

Radio interference statement 2

APS Microinverter System Introduction 3

APS Microinverter 500 series Introduction 5

APS Microinverter System Installation 6

Additional Installation components from APS 6

Required Parts and Tools from installer 6

Installation Procedures 7

Step 1 - Installing the AC Branch Circuit Junction Box 7

Step 2 – Attaching the APS Microinverters to the Racking or the PV Module Frame 8

Step 3 - Connecting the APS Microinverter to the PV Module 9

Step 4 - Ground the System 10

Step 5 –Connecting APS Microinverters to the AC Cables 11

Step 6 - Completing the APS Installation Map 12

APS Microinverter system operating instructions 13

Troubleshooting 14

- Status Indications and Error Reporting 14
- Operation LED 14
- GFDI Error 14
- Other Faults 14

Troubleshooting a non-operating APS Microinverter 15-16

Replace a Microinverter 17

Technical Data 18-19

Efficency Curves 20

Wiring Diagrams 21

- Sample Wiring Diagram – 120V/240V Split Phase 21
- Sample Wiring Diagram – 120V/ 208V Three Phase 22

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS! *This manual contains important instructions to follow during installation and maintenance of the APS Photovoltaic Grid-connected Inverter (Microinverter). To reduce the risk of electrical shock and ensure the safe installation and operation of the APS Microinverter, the following symbols appear throughout this document to indicate dangerous conditions and important safety instructions.*

WARNING SYMBOL

WARNING: This indicates a situation where failure to follow instructions may cause a serious hardware failure or personnel danger if not applied appropriately. Use extreme caution when performing this task.

NOTE SYMBOL

NOTE: This indicates information that is important for optimized Microinverter operation. Follow these instructions closely.

SAFETY INSTRUCTIONS

- ✔ **Do NOT disconnect the PV module from the APS Microinverter without first disconnecting the AC power.**
- ✔ Only qualified professionals should install and/or replace APS Microinverters.
- ✔ Perform all electrical installations in accordance with local electrical codes.
- ✔ Before installing or using the APS Microinverter, please read all instructions and cautionary markings in the technical documents and on the APS Microinverter system and the PV-array.
- ✔ *Be aware that the body of the APS Microinverter is the heat sink and can reach high temperatures. To reduce risk of burns, do not touch the body of the Microinverter.*
- ✔ *Do NOT attempt to repair the APS Microinverter.* If it fails, contact APS Customer Support (206-855-5100) to obtain an RMA number and start the replacement process. Damaging or opening the APS Microinverter will void the warranty.

Radio Interference Statement

RADIO INTERFERENCE STATEMENT

FCC Compliance: The equipment complies with the limits for a class B digital device, pursuant to part 15 of the FCC Rules, which are designed to protect against harmful interference in a residential installation. The equipment could radiate radio frequency energy and this might cause harmful interference to radio communications if instructions were not followed when installing and using the equipment. But there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, the following measures might resolve the issues:

A) Relocate the receiving antenna and keep it well away from the equipment

B) Consult the dealer or an experienced radio/TV technician for assistance.

Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate the equipment.

APS YC500-A System Introduction

The APS Microinverter is used in utility-interactive grid-tied applications, comprised of three key elements:

- APS Microinverter
- APS Energy Communication Unit (ECU)
- APS Energy Monitor and Analysis (EMA) web-based monitoring and analysis system

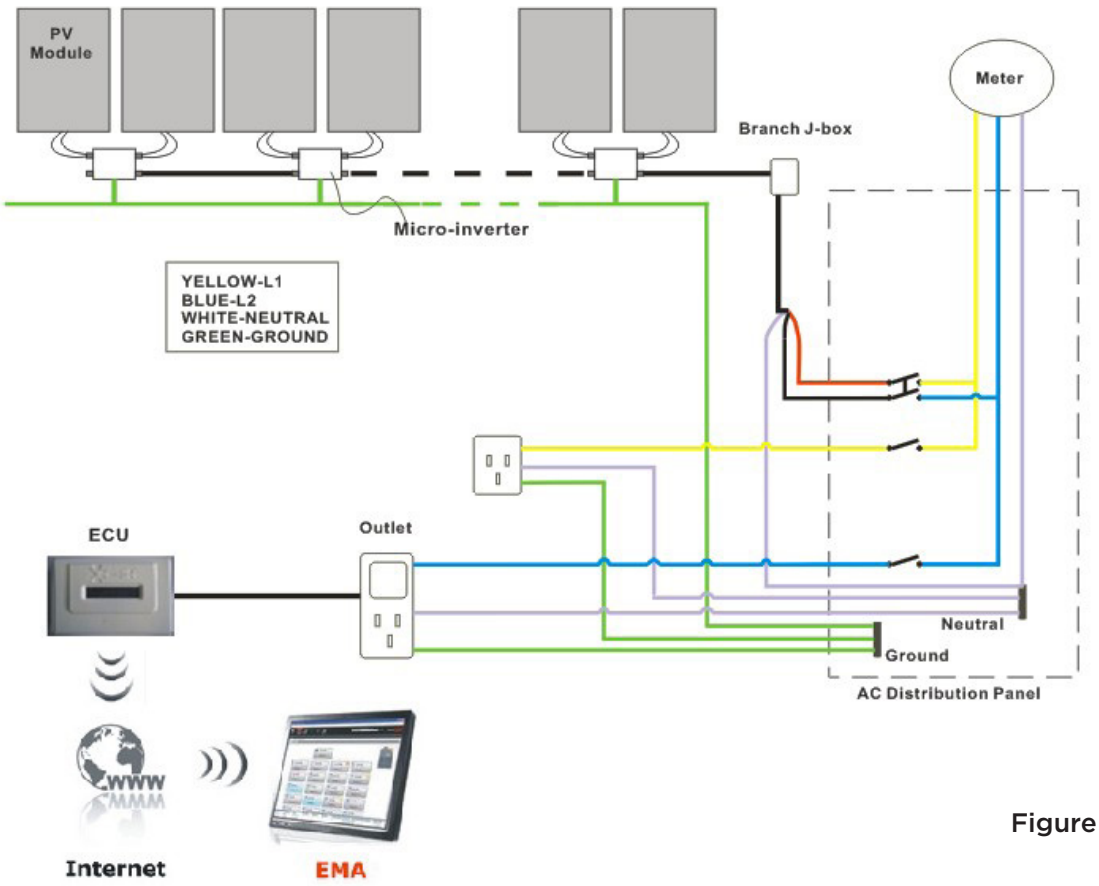


Figure 1

APS Microinverters maximize PV energy production

Each PV module has individual Maximum Peak Power Tracking (MPPT) controls, which ensures that the maximum power is exported to the utility grid regardless of the performance of the other PV modules in the array. When PV modules in the array are affected by shade, dust, orientation, or any situation in which one module underperforms compared with the other units, the APS Microinverter ensures top performance from the array by maximizing the performance of each module within the array.

More reliable than centralized or string inverters

The distributed APS Microinverter system ensures that no single point of system failure exists across the PV system. APS Microinverters are designed to operate at full power at ambient outdoor temperatures of up to 149°F (65°C). The inverter housing is designed for outdoor installation and complies with the IP65 environmental enclosure rating.

Simple to install

You can install individual PV modules in any combination of module quantity, orientation, type, and power rate.

Smart system performance monitoring and analysis.

The APS Energy Communication Unit (ECU) is installed by simply plugging it into any wall outlet and providing an Ethernet or Wi-Fi connection to a broadband router or modem. After installing the ECU, the full network of APS Microinverters automatically reports to the APS Energy Monitor and Analysis (EMA) web server. The EMA software displays performance trends, informs you of abnormal events, and controls system shutdown when it is needed. (See ECU manual for instructions.)

The APS 500 series Microinverters connect with the Split-phase grid, and operate with most 60 and 72 cell PV modules. For more information, please see the Technical Data page (p.18) of this manual.

MODEL NUMBER	AC GRID	PV MODULE	MODULE CONNECTOR
YC500	60Hz/240V	60,72 Cell	MC-4 Type or Customize

Maximum units per branch of YC500

Max. parallel combination of APS modules = 7/branch for 20 A breaker (14 PV modules)

The APS YC500 has two independent DC inputs, each with independent MPPT control and data monitoring.

The following figure shows the APS YC500 Microinverter schematic:

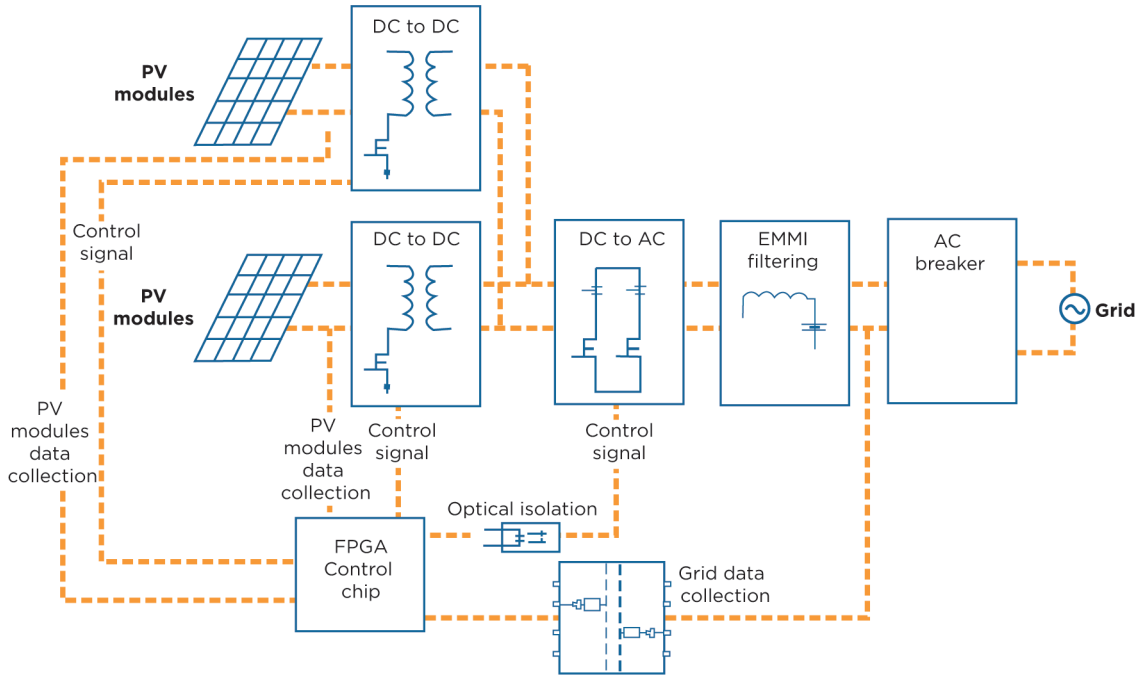


Figure 2

APS Microinverter System Installation

A PV system using APS Microinverters is simple to install. Each Microinverter easily mounts on the PV racking, directly beneath the PV module(s). Low voltage DC wires connect from the PV module directly to the Microinverter, eliminating the risk of high DC voltage. Installation *MUST* comply with local regulations and technical rules.

WARNING: Perform all electrical installations in accordance with local electrical codes.

WARNING: Be aware that only qualified professionals should install and/or replace APS Microinverters.

WARNING: Before installing or using an APS Microinverter, please read all instructions and warnings in the technical documents and on the APS Microinverter system itself as well as on the PV array.

WARNING: Be aware that installation of this equipment includes the risk of electric shock.

WARNING: Do not touch any live parts in the system, including the PV array, when the system has been connected to the electrical grid.

Additional Installation components from APS

- AC branch end cable (1 per branch, sold separately)
- Protective end cap (1 per branch, sold separately)

Required Parts and Tools from Installer

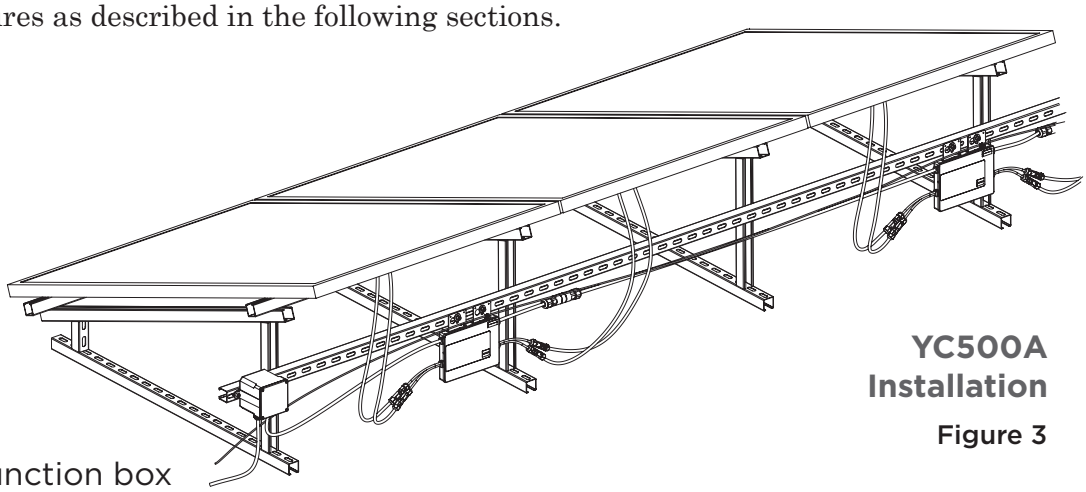
In addition to your PV array and its associated hardware, the following tools are required for assembly:

- One AC connection junction box
- Mounting hardware suitable for module racking
- Sockets and wrenches for mounting hardware
- Continuous grounding conductor and grounding washers
- Phillips screwdriver
- Torque wrench

Installation Procedures

APS Microinverters are designed to only operate when they can sense power coming from the grid. Even if they are plugged into the PV array, they will not turn themselves on until they can read power from the grid.

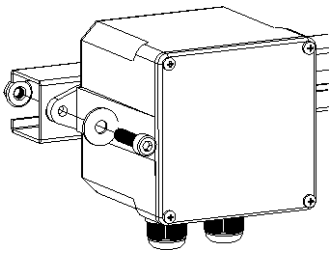
WARNING: Do NOT connect APS Microinverters to the utility grid or energize the AC circuit until you have completed all of the installation procedures as described in the following sections.

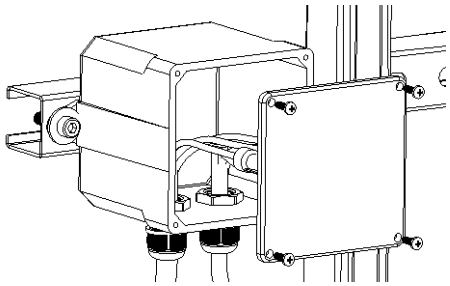


YC500A Installation

Figure 3

Step 1 - Installing the AC Branch Circuit Junction Box





A. Install an appropriate junction box at a suitable location on the PV racking system (typically at the end of a branch of modules).

B. Connect the open wire end of the AC branch end splice cable into the junction box using an appropriate gland or strain relief fitting.

C. Wire the conductors: L1- RED; L2 - BLACK; N -WHITE.

D. Connect the AC branch circuit junction box to the point of utility interconnection.

NOTE: *Be sure to size the AC wire to account for voltage drop between the AC branch circuit junction box and the point of utility interconnection. (See wire size diagram on following page.)*

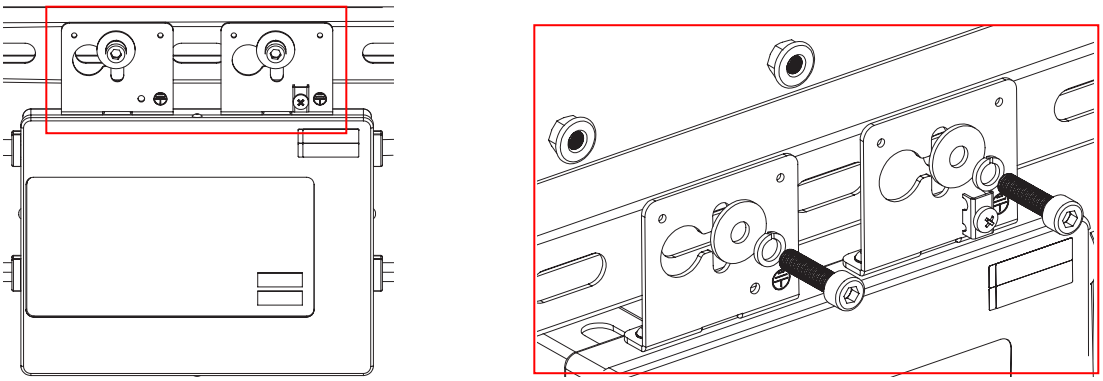
YC500 Number per Branch

EXTERNAL WIRE SIZE (AWG)	2	3	4	5	6	7*	8	9
	MAXIMUM EXTERNAL CABLE LENGTH (ft)							
12	370.7	237.1	167.9	124.3	93.6	70.2	51.4	35.7
10	593.1	379.4	268.6	198.9	149.7	112.3	82.3	57.1
8	926.8	592.9	419.6	310.7	233.9	175.5	128.6	89.3
6	1482.8	948.6	671.4	497.1	374.3	280.8	205.7	142.9

*7 is the maximum number/branch with a 20 amp breaker

Step 2 – Attaching the APS Microinverters to the Racking or the PV Module Frame

Figure 5



A. Mark the location of the Microinverter on the rack, keeping in mind the PV module junction box or any other obstructions.

B. Mount one Microinverter at each of these locations using hardware recommended by your module racking vendor.

C. GROUNDING WASHER: If using the appropriate grounding washer (check with a licensed electrician); attach the grounding washer between the frame and the Microinverter.

WARNING: Prior to installing any of the Microinverters, verify that the utility voltage at the point of common connection matches the voltage rating on the Microinverter label.

WARNING: Do not mount the Microinverter in a location that allows exposure to direct sunlight. Allow a minimum of 3/4" (1.5 cm.) between the roof and the bottom of the Microinverter to allow proper air flow.

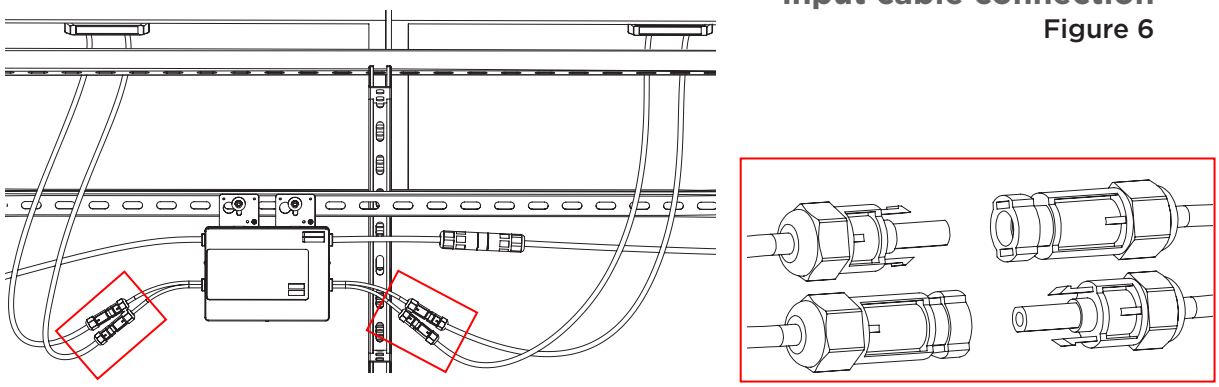
NOTE: Connecting cables (steps 3-5) can be done in any order but DO NOT connect to the utility power grid until all the steps are completed.

Step 3 – Connecting APS Microinverters to the PV Module

Connect the DC cables from the PV Modules to the Micro-Inverter per the diagram below:

Note: When plugging in the DC cables, the Microinverter should immediately blink green three times. This will happen as soon as the cables are plugged in and will show that the Microinverter is functioning correctly. This entire check function will start and end within 5 seconds of plugging in the unit, so pay careful attention to these lights when connecting the DC cables.

Photovoltaic panels and Microinverter DC input cable connection
Figure 6



WARNING: Insure that all AC and DC wiring is correct. Check that none of the AC and DC wires are pinched or damaged. Be sure that all junction boxes are properly closed.

Step 4 - Ground the System

NOTE: If you already use grounding washers (WEEB) to ground the Microinverter chassis to the PV module racking as described in Step 2C, skip this step.

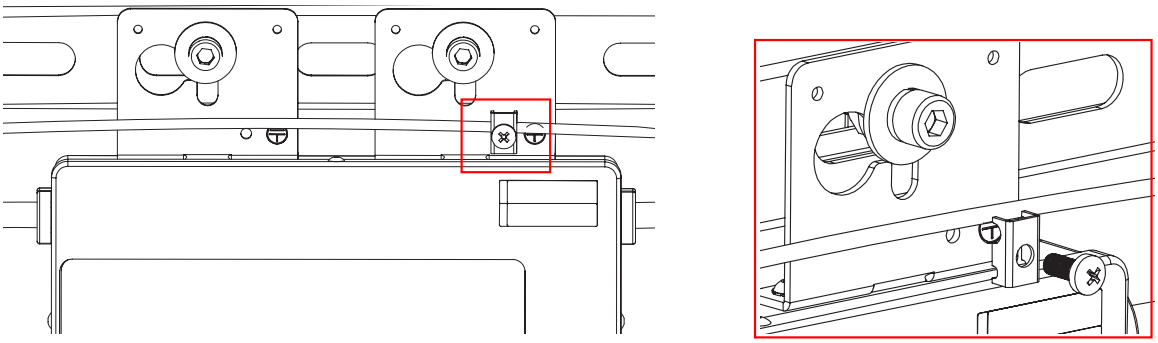


Figure 7

Each APS Microinverter comes with a ground clamp that can accommodate a single #6 awg strand and #4 awg solid conductor. Check your local electrical code for grounding conductor sizing requirements. Connect the grounding electrode conductor to the microinverter ground clamp.

NOTE: The AC output neutral is not bonded to ground inside the microinverter.

Step 5 - Connecting the APS Microinverter to the PV Module

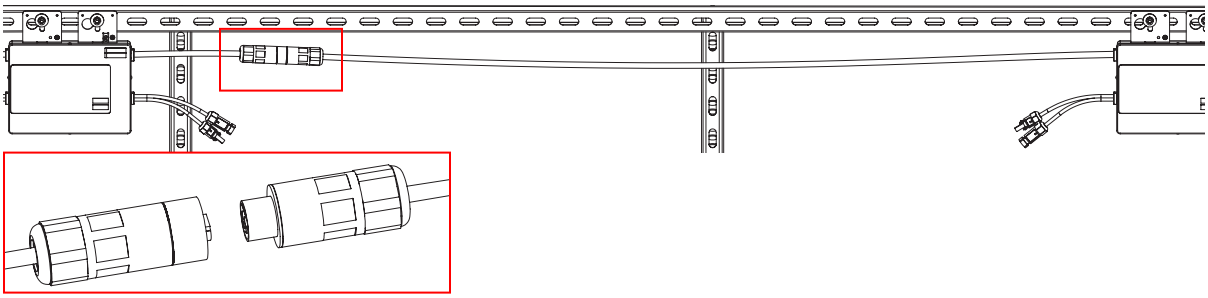


Figure 8

A. Check the Microinverter datasheet for the maximum allowable number of Microinverters on one AC branch circuit.

B. Install a protective end cap on the open AC connector of the last Microinverter in the AC branch circuit.

C. Plug the AC female connector of the last Microinverter into the male connector of the next Microinverter, and so on, to form a continuous AC branch circuit.

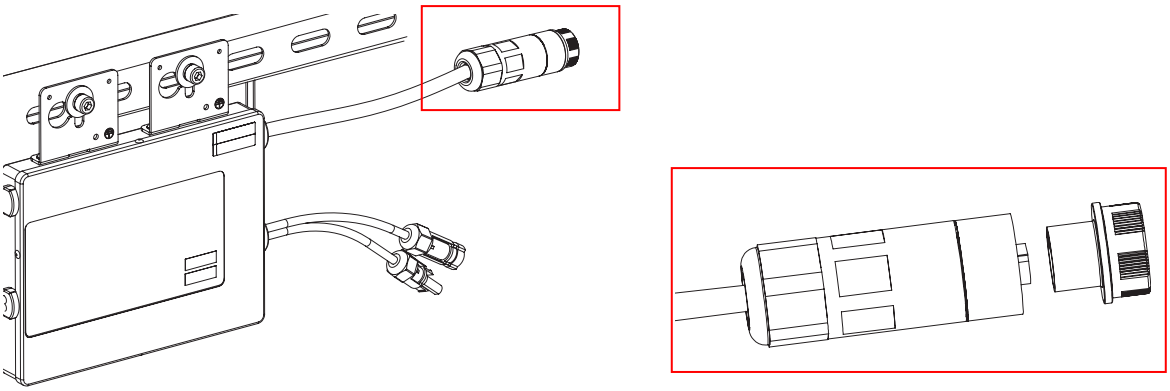


Figure 9

WARNING: Do NOT exceed the maximum number of Microinverters in an AC branch circuit, as displayed on the unit label.

Step 6 - Completing the APS Installation Map

Fill in the APS Registration Cards, which provide system information and the installation map. Feel free to provide your own layout if a larger or more intricate installation map is required. The layout map provided is designed to accomodate labels in vertical or horizontal orientation to meet all the field PV connections.

1. Each APS Microinverter has removable serial number labels. Peel a label off, and affix it to the respective location on the APS installation map.
2. Fill out the warranty cards and email to APS at emasupport@altenergy-power.com
3. APS will create the EMA account and email you the account information. Then you can use the EMA website to view detailed performance of your PV system.

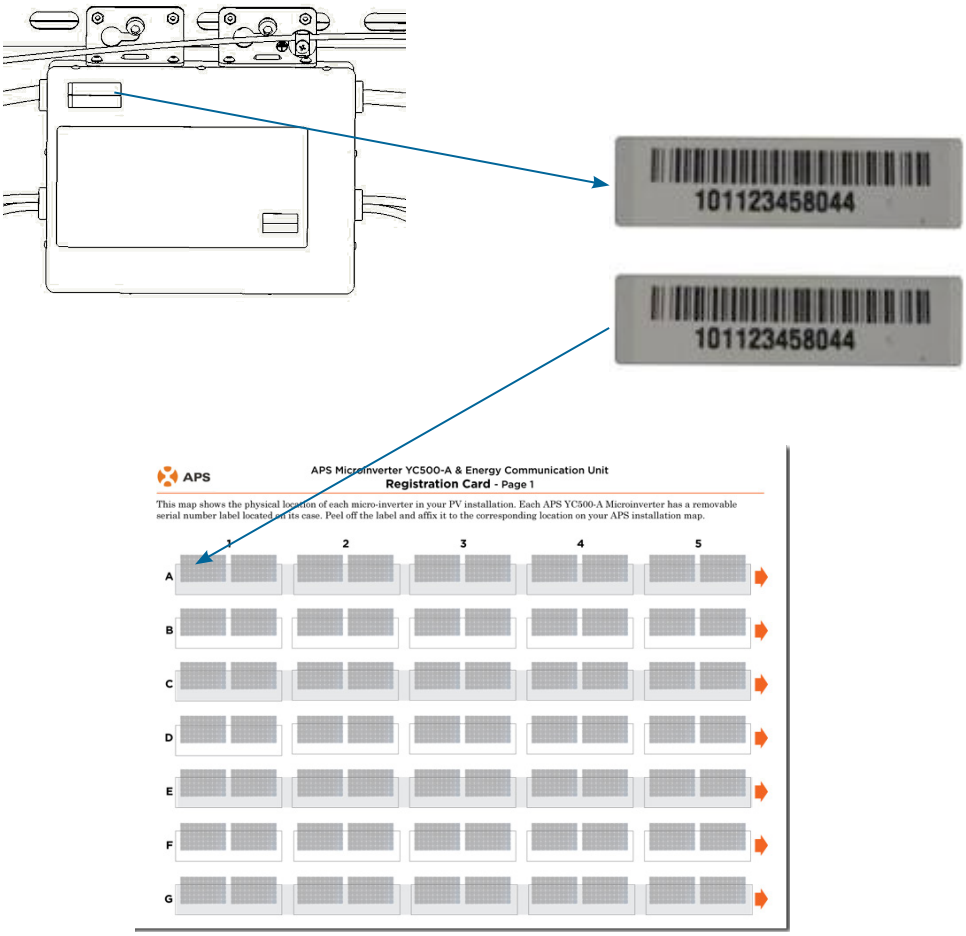


Figure 10

APS Microinverter System Operating Instructions

To operate the APS Microinverter PV system:

1. Turn ON the AC circuit breaker on each Microinverter branch circuit.

2. Turn ON the main utility grid AC circuit breaker. Your system will start producing power after a five-minute wait time.

3. The units should start blinking green every 2 seconds five minutes after turning on the AC circuit breaker. This means they are producing power normally, but have not yet connected to the ECU. After the ECU has been plugged in and acknowledges the Microinverters, they will start to blink green every 10 seconds.

4. Plug in the ECU and follow the instructions according to the manual for the ECU.

5. The APS Microinverters will start to send performance data over power line to the ECU. The time required for all the Microinverters in the system to report to the ECU will vary with the number of Microinverters in the system. You can verify proper operation of the APS Microinverters via the ECU. See the ECU Installation and Operation Manual for more information.

Troubleshooting

Qualified personnel can use the following troubleshooting steps if the PV system does not operate correctly:

Status Indications and Error Reporting

START UP LED

One quick red light followed by three short green blinks when DC power is first applied to the Microinverter indicates a successful Microinverter startup

Operation LED

Flashing Slow Green (10 sec. gap) - Producing power and communicating with ECU

Flashing Fast Green (2 sec. gap) – Producing power and not communicating with ECU

Flashing Red – Not producing power

GFDI Error

A solid red LED indicates the Microinverter has detected a Ground Fault Detector Interrupter (GFDI) error in the PV system. Unless the GFDI error has been cleared, the LED will remain red and the ECU will keep reporting the fault.

After the ground fault error is fixed, follow the instructions in the ECU Installation and Operation Manual to clear this GFDI error reporting.

Other Faults

All other faults are reported to the ECU. Refer to the *ECU Installation and Operation Manual* for a list of additional faults and troubleshooting procedures.

WARNING: Only qualified personnel should directly handle the APS Microinverter.

WARNING: Never disconnect the DC wire connectors under load. Ensure that no current is flowing in the DC wires prior to disconnecting.

WARNING: Always disconnect AC power before disconnecting the PV module wires from the APS Microinverter. Either disconnecting by the appropriate AC circuit breaker or unplugging the first AC connector of the first Microinverter in a branch circuit is suitable as a

means of disconnection.

WARNING: The APS Microinverter is powered by PV module DC power. AFTER disconnecting the DC power, when reconnecting the PV modules to the Microinverter, be sure to watch for the three short LED flashes.

A non-operating APS Microinverter

There are two possible overall areas of trouble:

A. The Microinverter itself may be having problems, or

B. The Microinverter itself is working fine but it is having trouble communicating with the ECU. The items below refer to Microinverter issues, not communication issues (*addressed in the ECU manual*).

A quick way to tell whether the issue is the Microinverter or a communication problem with the ECU:

1. **Diagnosing from the Micro-Inverter:** A red light – either blinking or solid on the Microinverter, or no light at all. No light, or a red light, means it is definitely a Microinverter problem.
2. **Diagnosing from the ECU:**
   a. **No-Data-Display:** This is probably a communication issue- not a Microinverter problem.
   b. **Problems with erratic display**: Data is displayed for some period and then no data is displayed: most likely a communication issue.
   c. **0 watts, or 2 watts**: Possibly a Microinverter problem
   d. **Erratic data display** that is not coordinating with data displays from other units: most likely a Microinverter problem.

TO TROUBLESHOOT A NON-OPERATING APS MICROINVERTER, FOLLOW THE STEPS BELOW IN ORDER:

1. Verify the utility voltage and frequency are within ranges shown in the Technical Data section of this manual.
2. Check the connection to the utility grid. Verify utility power is present at the inverter in question by removing AC, then DC power. Never disconnect the DC wires while the Microinverter is producing power. Re-connect the DC module connectors and watch for three short green LED flashes.

Troubleshoot a Non-operating APS Microinverter. . .
continued on next page

. . .TROUBLESHOOT A NON-OPERATING APS MICROINVERTER

3. Check the AC branch circuit interconnection between all the Microinverters. In rare cases, the wire in the AC plug may have worked loose. This will need to be reviewed by a qualified electrician. Verify each inverter is energized by the utility grid as described in the previous step.
4. Make sure that all AC breakers are functioning properly and are closed.
5. Check the DC connections between the Microinverter and the PV module.
6. Verify the PV module DC voltage is within the allowable range shown in the Section 8 Technical Data of this manual.
7. If the problem persists, please call APS Customer Support at (206) 855-5100.

WARNING: Do not attempt to repair the APS Microinverter. If troubleshooting methods fail, please return the Microinverter to your distributor for replacement.

Replace a Microinverter

Follow this procedure to replace a failed APS Microinverter

A. Disconnect the APS Microinverter from the PV Module, in the order shown below:

1. Disconnect the AC by turning off the branch circuit breaker.
2. Disconnect the first AC connector in the branch circuit.
3. Disconnect the PV module DC wire connectors from the micro-inverter.
4. Remove the Microinverter from the PV array racking.

B. Install a replacement Microinverter to the rack. Remember to observe the flashing LED light as soon as the new Microinverter is plugged into the DC cables.

C. Connect the AC cable of the replacement Microinverter and the neighboring Microinverter to complete the branch circuit connections.

D. Close the branch circuit breaker, and verify operation of the replacement Microinverter.

WARNING: Be sure to verify the voltage and current specifications of your PV module match with those of the Microinverter. Refer to the APS website http://www.altenergy-power.com for a list of approved PV modules.

WARNING: You must match the DC operating voltage range of the PV module with the allowable input voltage range of the APS Microinverter.

WARNING: The maximum open circuit voltage of the PV module must not exceed the specified maximum input voltage of the APS

APS YC500A Microinverter Datasheet

INPUT DATA (DC)

Recommended PV Module Power Range (STC)	180-310W
MPPT Voltage Range	22-45V
Maximum Input Voltage	55V
Maximum Input Current	12A X 2

OUTPUT DATA (AC)

Rated Output Power	500W
Maximum Output Current	2.08A @ 240V 2.4A @208V
Nominal Output Voltage/Range - 240V	240V/211V-264V*
Nominal Output Voltage/Range - 208V	208V/183V-229V*
Nominal Output Frequency/Range	60Hz/ 59.3-60.5Hz*
Power Factor	>0.99
Total Harmonic Distortion	<3%
Maximum Units Per Branch	7 per 20A @ 240V 6 per 20A @ 208V

EFFICIENCY

Peak Efficiency	95.5%
CEC Weighted Efficiency**	95%
Nominal MPP Tracking Efficiency	99.5%

MECHANICAL DATA

Storage Temperature Range	-40°F to +185°F (-40°C to +85°C)
Operating Temperature Range (Ambient)	-40°F to +149°F (-40°C to +65°C)
Operating Temperature Range (Internal)	-40°F to +185°F (-40°C to +85°C)
Dimensions (WxHxD) inches	8.75” x 6.5” x 1.1”
Dimensions (WxHxD) mm	221mm x 167mm x 29mm
Weight	5.5 lbs (2.5kg)
Enclosure Rating	NEMA 4X
Cooling	Natural Convection

FEATURES & COMPLIANCE

Communication	Power line
Design Life	25 years
Emissions & Immunity (EMC) Compliance	FCC PART 15, ANSI C63.4 2003, ICES-003
Safety Class Compliance	UL 1741 , CSA C22.2, No. 107.1-01, NEC2014 690.12
Grid Connection Compliance	IEEE 1547

Specifications subject to change without notice – please ensure you are using the most recent update found at www.APSamerica.com

* Programmable per customer and utility requirements. All settings UL approved

**CEC registered as Altenergy Power System Inc.

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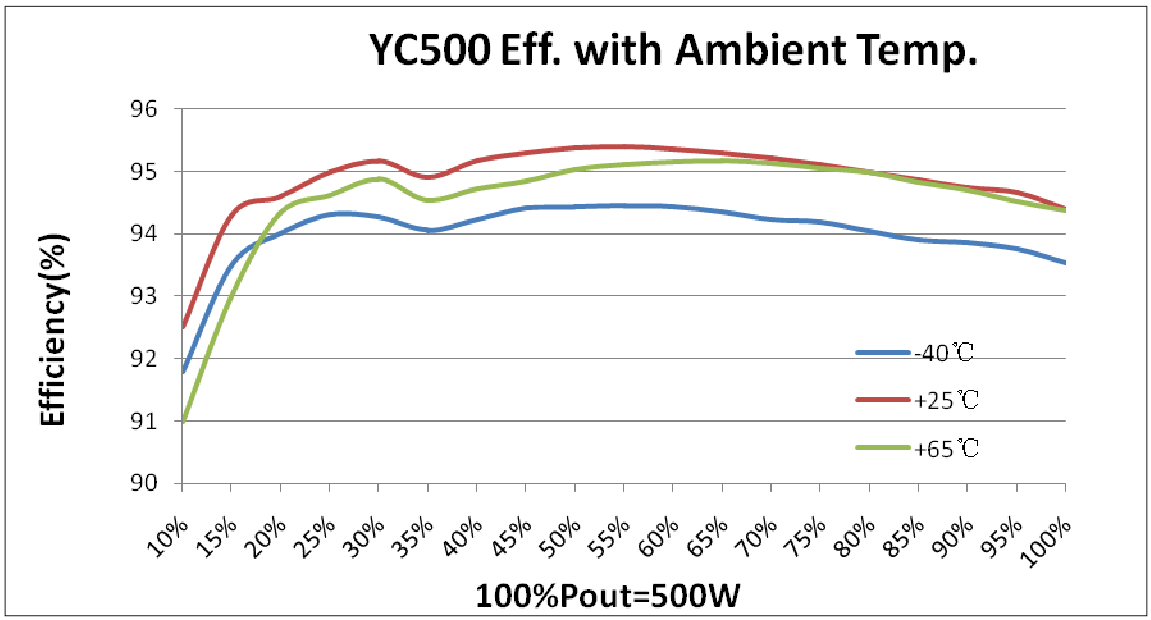
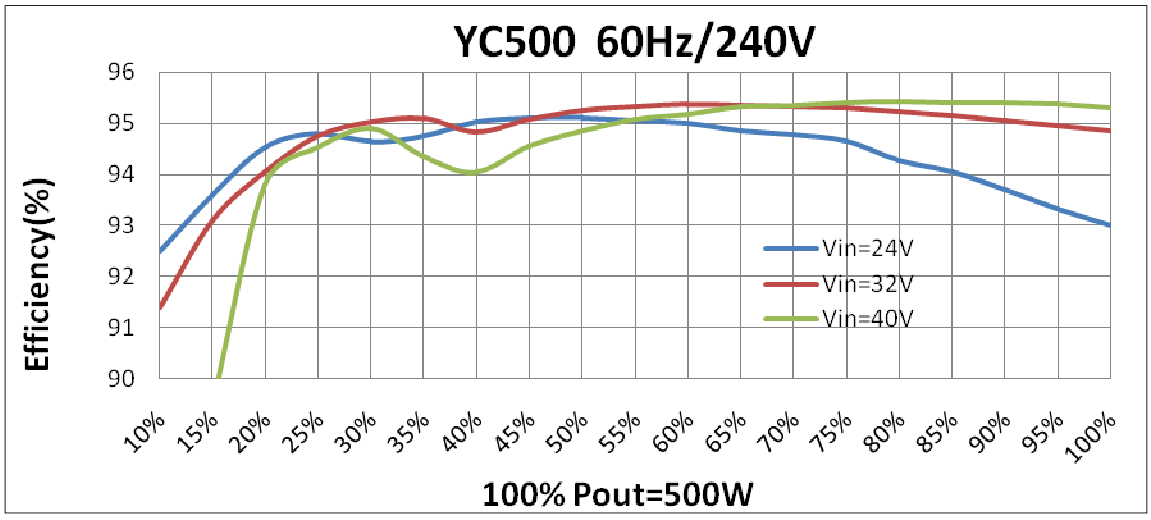
APS MICROINVERTER

Efficency Curves

YC500-NA Efficency-temperature Curves



YC500-NA Efficency Curves



Sample Wiring Diagram - 120V/240V Split Phase

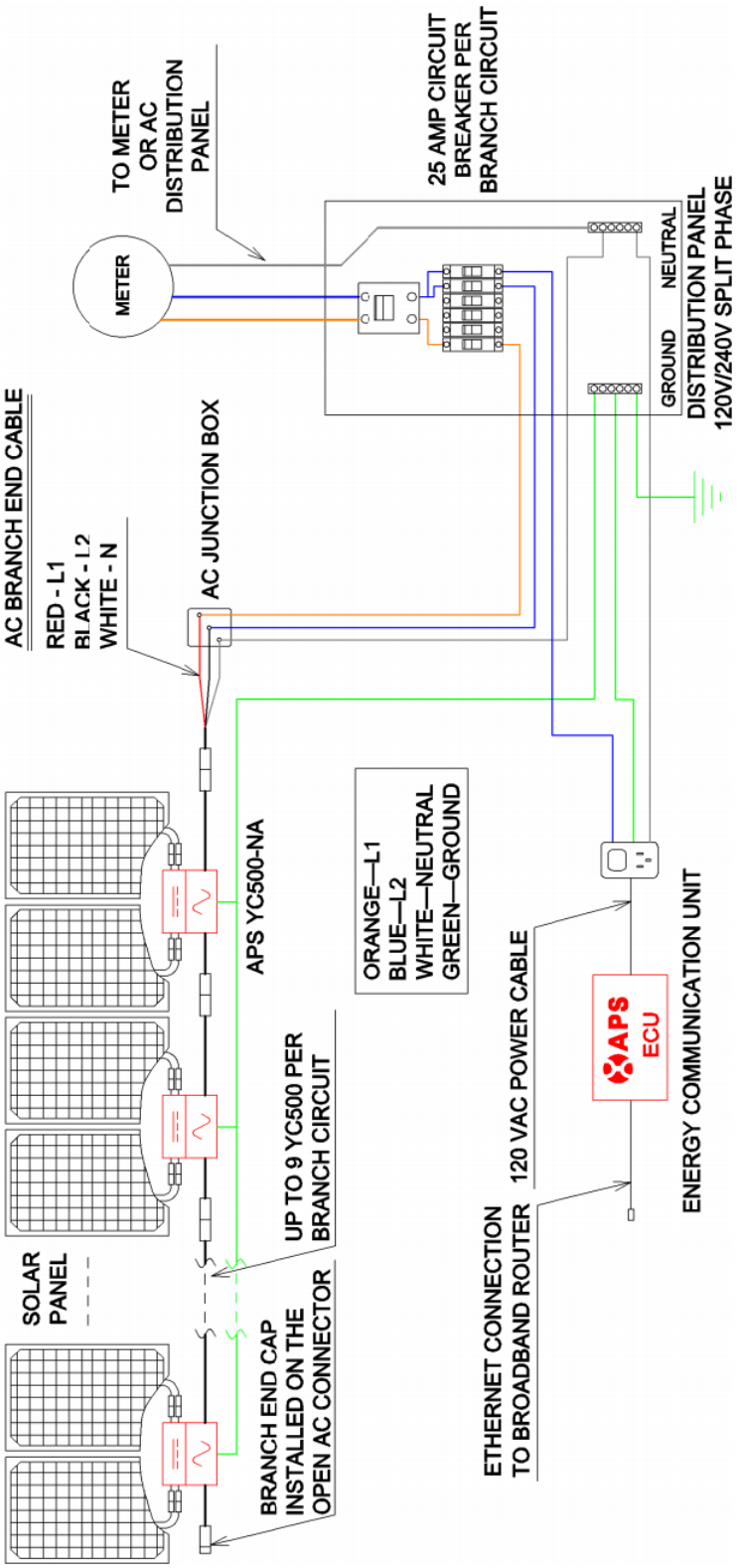


Figure 11

Sample Wiring Diagram - 120V/208V Three Phase

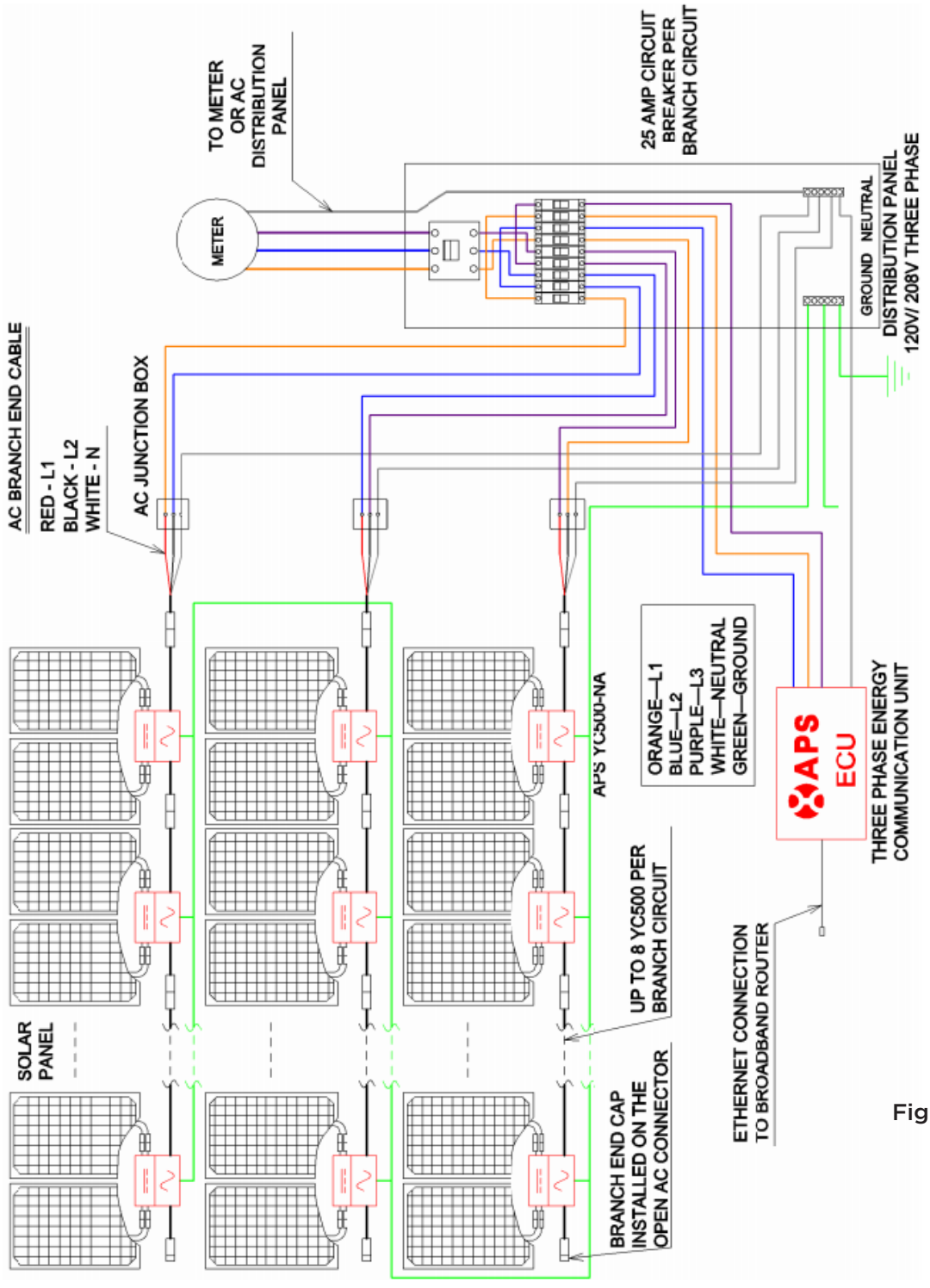


Figure 12

NOTE: The ECU should function properly when connected to L1, L2 or L3.